

biofilms9-123

<https://doi.org/10.5194/biofilms9-123>

biofilms 9 conference

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Influence of different copper materials on biofilm control using chlorine and mechanical stress

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The selection of materials for plumbing application has potential implications on the chemical and microbiological quality of the delivered water. This work aims to evaluate the action of materials with different copper content (0, 57, 96 and 100%) on biofilm formation and control by chlorination and mechanical stress. A strain of *Stenotrophomonas maltophilia* isolated from drinking water was used as model microorganism and biofilms were developed in a rotating cylinder reactor (RCR) using realism-based shear stress conditions. Biofilms were characterized phenotypically and exposed to three control strategies: 10 mg/l of free chlorine for 10 min; an increased shear stress (equivalent to 1.5 m/s of fluid velocity); and the combination of both treatments. Biofilms formed on the copper materials had lower wet mass and produced significantly lower amounts of extracellular proteins than those formed on stainless steel (0% of copper content). Although, the effects of copper materials on biofilm cell density was not significant, these materials had important impact on the efficacy of chemical and/or mechanical treatments. Biofilms formed on 96 or 100% copper materials had lower content of culturable bacteria than that observed on stainless steel after exposure to chlorine or shear stress. The mechanical treatment used had no relevant effects in biofilm control. The combination of chemical and mechanical treatments only caused higher culturability reduction than chlorine in biofilms formed on 57% copper alloy. The number of viable cells present in bulk water after biofilm treatment with chlorine was lower when biofilms were formed on any of the copper surface. The overall results are of potential importance on the selection of materials for drinking water distribution systems, particularly for house and hospital plumbing systems to overcome the effects from chlorine decay. Copper alloys may have a positive public health impact by reducing the number of viable cells in the delivered water after chlorine exposure and improving the disinfection of DW systems. Moreover, the results demonstrate that residual chlorine and mechanical stress, two strategies conventionally used for disinfection of drinking water distribution systems, failed in *S. maltophilia* biofilm control.

Acknowledgements:

This work was the result of the projects: UIDB/00511/2020 of the Laboratory for Process Engineering, Environment, Biotechnology and Energy – LEPABE – funded by national funds through the FCT/MCTES (PIDDAC); PTDC/BII-BTI/30219/2017 – POCI-01-0145-FEDER-030219; POCI-01-0145-FEDER-006939, funded by FEDER funds through COMPETE2020 – Programa Operacional Competitividade e Internacionalização (POCI) and by national funds (PIDDAC) through FCT/MCTES; NORTE-01-0145-FEDER-000005 – LEPABE-2-ECO-INNOVATION, supported by Norte Portugal Regional Operational Programme (NORTE 2020), under PORTUGAL 2020 Partnership Agreement, through the European Regional Development Fund (ERDF).

How to cite: Gomes, I. B., Simões, L., and Simões, M.: Influence of different copper materials on biofilm control using chlorine and mechanical stress , biofilms 9 conference, Karlsruhe, Germany, 29

